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OBITUARY AND BIBLIOGRAPHY OF KENNETH S. HAGEN (1919–1997), DEDICATED ENTOMOLOGIST AND TEACHER

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Kenneth Sverre Hagen, professor emeritus of Entomology at the University of California, Berkeley, and past president of the Pacific Coast Entomological So-

Figure 1. Collecting trip in Sunset Valley, near Santa Barbara, California in 1939, with (L–R) Edwin Van Dyke, Burdett White, Bill Barr & Ken Hagen.

ciety, died suddenly of a ruptured aortic aneurism on 10 Jan 1997. He is survived by his wife Maxine, his son Kent, and his brother Paul. Worldwide he was regarded as an authority on biological control and insect nutrition. Those who worked with him, also regarded him as the first one to go to for an identification, a literature source, or a cup of coffee.

Ken was born in Oakland, California on 26 Nov 1919. His parents were from Norway, and his father was a seaman, serving on such ships as the Balclutha, and eventually reached the rank of first mate. Ken's mother passed away when he was a teenager, and he and his brother had to fend for themselves when their father was away on a voyage.

As a boy, Ken enjoyed chemistry and natural history, and collecting insects was a favorite pastime, but it was a favored teacher in the 9th grade at Lockwood Junior High School who recognized his talents and stimulated him to focus on science as a career. Ken attended Fremont High School in Oakland, where he played football and set a high jump record in track. He graduated from Fremont High in 1938, and then enrolled in San Francisco State College. During this time, his love of natural history led him to the California Academy of Sciences, first as a part-time preparator of insects, and later as an assistant caretaker in the Steinhart Aquarium. He went collecting with Edwin van Dyke, and climbed Mt. Whitney with his fellow coleopterist, Bill Barr. At San Francisco State he continued to play football, and received his A.A. degree in 1942.

Ken then attended U.C. Berkeley, where he was offered a football scholarship. However, Ken did not play football at Cal, but concentrated on his studies (taking up to 24 units a term) to earn his B.S. in entomology in 1943. He then went to

Officer Candidate School at Columbia University, where was commissioned in the U.S. Navy as one of the "90 day wonders". Ken was then given a brief leave, which he used to return to Oakland and marry his fiancee, Maxine White, on 1 Dec 1943. A week later he went to Norfolk, Virginia to attend Amphibious Training School, and then was shipped out to Europe.

During the war he served on the USS Anne Arundel, as a lieutenant in charge of a landing craft section, and saw action in the Neptune Invasion at Omaha Beach in Normandy, and the Dragon Invasion in the south of France in 1944. In 1945, he participated in the landings at Okinawa (where the fierce fighting stranded his boat on the beach overnight), and later helped transport Chinese troops. He developed quite a reputation among his comrades for his entomological interests—en route for the Pacific, Ken was seen leaning over the rail with a net, sweeping the vegetation while passing through the Panama Canal.

In 1946, Ken came back to California and was hired as the supervising entomologist for the West Side Alfalfa Pest Control Association in California's Central Valley, responsible for overseeing 10,000 acres of alfalfa, and becoming the first supervised control entomologist in California. This position played a key role in the development of integrated pest management, and was the predecessor of today's pest control advisor. Ken then returned to Berkeley as a graduate student, working as a technician in the Division of Biological Control. He received his M.S. there in 1948, and his Ph.D. in 1952, under the direction of Richard Doutt. This was a particularly rich time to be at Berkeley, as Ken studied under such luminaries as E. O. Essig, E. G. Linsley, R. L. Usinger and A. E. Michelbacher. He also spent a year in Oahu working on the oriental fruit fly with Robert van den Bosch, and worked in the statewide Department of Biological Control under Harry Scott Smith, whose signed photograph was one of Ken's treasured possessions. He was appointed Junior Entomologist in the Division of Biological Control, Agricultural Experiment Station (at the Gill Tract in Albany, California) in 1952, and advanced to Entomologist in 1965, and to Professor of Entomology in 1969. Ken took a special leave of absence from 1961 to 1963 to work for the government of Greece to advise and develop culturing techniques for the olive fly. He officially retired in 1990, but continued to work at the Gill Tract until the day of his death. It was remarked that the way you knew Ken was retired was that he only worked half a day on Saturday.

Biological control was his passion as well as his profession. Biocontrol has been subdivided into the three tactics of importation, conservation and augmentation. Evidence of Ken's solid training and great command of the field was that he was well-versed in all three. Besides publishing on the history of biological control, Ken was involved in the importation of the natural enemies of pear psylla, acacia psyllid, spotted alfalfa aphid, blue alfalfa aphid, pea aphid, walnut aphid, plum aphid, european asparagus aphid, iceplant scales, Egyptian alfalfa weevil and walnut husk fly. He was familiar with the conservation of the natural enemies through his work on population monitoring and reducing insecticide usage for *Colias* caterpillars and aphids in alfalfa.

However, it was in the area of augmentation of natural enemies, coupled with insect nutrition, that Ken made his most important contributions to science. He was the first to develop an "artificial egg" for the mass-rearing of *Chrysoperla,* and helped develop artificial diets for mass-rearing *Trichogramma,* coccinellids

Figure 2. Some pioneers of modern biological control in Palm Canyon, Riverside County, California in 1948 (L–R) (front row) Stan Flanders, Glen Finney, Charles Fleschner, P. H. Timberlake, Everett Dietrick & Paul DeBach; (second row) Blair Bartlett, Ken Hagen, Prof. Harry Smith, Dave Lloyd, Harold Compere & Ed Steinhaus; (third row) Carl Huffaker, Ken Hughes (kneeling), Ted Fisher & A. J. Baisinger.

and tephritids. His innovative work, with Richard Tassan, on food sprays for predators was a major breakthrough in biological control and continues to serve as a basic example for augmentation of field populations of entomophagous insects. Ken considered that his most significant research contribution was presented in a 1986 paper, wherein he hypothesized that the occurrence of amino acids in honeydew helped protect honeydew producers from ant predation, and presented data showing that chrysopids were attracted to a combination of plant volatiles and kairomones from honeydew, but the attraction varied with the age of the crop.

Ken was truly a scientist of international stature and experience. He engaged in collaborative research in Mexico, Central America, Brazil, Greece, Kenya and China, but his travels also extended through Europe to India, Malaysia, Australia, New Zealand and Chile. Of the 22 visiting scientists and postdoctoral students he hosted in his lab, 18 were from other countries, and of the 28 graduate students he supervised, eight were from other countries, while he was an external examiner of dissertations of another ten students from outside the United States.

Ken's research interests extended beyond biological control, including aquatic Hymenoptera and the immature stages of Hymenoptera, but especially the biosystematics of Hymenoptera (Encyrtidae) and Coleoptera (Coccinellidae and Anthicidae). His work with the Coccinellidae included documenting the complex migratory behavior of the convergent ladybeetle, which involved the use of hot air balloons and scoops fitted onto fixed wing aircraft to sample airborne beetles. This work led to an article in the National Geographic (1970) entitled "Following

Figure 3. At Gill Tract, Albany, California in 1985: (L–R) Chuck Kennett, Carl Huffaker, Dick Doutt & Ken Hagen.

the ladybug home". Ken was particularly pleased with that issue, since it also included an article on his ancestors, the Vikings.

He codescribed *Karpinskiella paratomicobia* (Hymenoptera: Pteromalidae) (Hagen & Caltagirone 1968), and had the following patronyms named in his honor: *Notoxus hageni* (Coleoptera: Anthicidae) (Chandler 1982), *Gnathoweisea hageni* (Coleoptera: Coccinellidae) (Gordon 1985), *Olla hageni* (Coleoptera: Coccinellidae) (Vandenberg 1992), *Meleoma kennethi* (Neuroptera: Chrysopidae) (Tauber 1969), *Metaphycus hageni* (Hymenoptera: Encyrtidae) (Daane & Caltagirone, 1999), and the Hagen glands in Braconidae (Hymenoptera) (Buckingham & Sharkey 1988).

Ken was a member of the Entomological Society of America (president of the Pacific Branch in 1979 and fellow), American Entomological Society, Entomological Society of Canada (fellow), Pacific Coast Entomological Society (president 1968–69 and Honored Member), Entomological Society of Washington, Kansas Entomological Society, Hawaiian Entomological Society, Georgia Entomological Society, Society of Systematic Zoology, the Coleopterists Society, American Association for the Advancement of Science (fellow), American Institute of Biological Sciences, International Society of Hymenopterists, and the International Organization of Biological Control (president 1980–84).

He was honored at the 1989 national meeting of the Entomological Society of America with a symposium entitled "Native and Introduced Predaceous Coccinellidae: A Tribute to Kenneth S. Hagen for His Contributions to Coccinellid Biology". In 1990 he was the recipient of the prestigious Berkeley Citation presented by the University of California, Berkeley, for outstanding service to the

University, and honored by the California State Senate Rules Committee Resolution #2513. In 1992 he received the Distinguished Service Award by the Association of Applied Insect Ecologists and the Lifetime Excellence in Entomology from the Hawaiian Entomological Society, and in 1993, the Distinguished Service Award (Honored Member) by the Pacific Coast Entomological Society. In 1995 the International Organization of Biological Control presented Ken with the Distinguished Biological Control Science Award, and he presented an invitational talk on the Chemical Ecology of Chrysopidae at the IOBC's conference honoring him. In 1998, a review of forage alfalfa pest management was dedicated to Ken (Summers 1998).

Irrespective of these many scientific honors, Ken Hagen was probably best known among his colleagues for several personal traits. First, he always kept a pot of coffee going in his lab, and this served as a focal point for staff and visitors to drop in and discuss entomology. Second, he had a virtual encyclopedic knowledge of entomology and biological control. At the Gill Tract, it was generally understood that if you had a question, your first stop should be Hagen's office. And if he didn't immediately know the answer to the question, as often as not, he was able to swivel around in his chair, and from his immense reprint collection pick out the appropriate reference. Finally, he was extremely generous with his time and knowledge. No matter who approached him, be it a professor, graduate student, staff personnel, farmer or member of the general public, Ken would be happy to lay aside whatever he was working on, and give that person his full attention until he got the answer, or could refer the person to the correct authority. And if the search dragged on, it did no good to tell Ken to forget it—he just "hung in there" and kept looking for your answer. Ken was also popular with the local elementary school teachers, taking out the young students to the Gill Tract's alfalfa field and showing them how to sweep for insects. To Ken, this commitment to teach others about entomology was as natural as can be, possibly reflecting his own debt of gratitude to those teachers who helped him, and he willed his substantial entomological library to the Division of Biological Control.

Ken liked working with wood and was a fine carpenter. He was also interested in sailing, stamp collecting, astronomy, and (due to his studies of anthicids) sand dunes. However, outside of entomology, Ken's greatest interest was book collecting. He was a keen bibliophile, and would bind his own books. His book and journal collection eventually outgrew his house, and when the house next to his came up for sale, Ken and Maxine ended up buying it, largely to use the garage as a storage space for his overflowing library.

A tireless researcher, a loyal and dedicated member of the University of California faculty, an enthusiastic teacher, a helpful and stimulating colleague, and a generous human being, Ken Hagen was, in every sense of the word, a true gentleman.

Bibliography Of K.S. Hagen

I have attempted to include all of Ken's writings to indicate the breadth of his interests. This list includes governmental reports, abstracts and non-scientific works which may not qualify as "published scientific articles". Except for those indicated with by asterisk (*), all items have been checked against the originals.

1. 1946. The occurrence of *Ceutorhynchus assimili* (Paykul) in California. Pan-Pacif. Ent. 22: 73.
2. 1949. Two new ichneumonid host records. Pan-Pacif. Ent. 25: 25.
3. 1949. (R. L. Doutt & K.S.H.) Periodic colonization of *Chrysopa californica* as a possible control of mealybugs. J. Econ. Ent. 42: 560.
4. 1949. (R. L. Doutt & K.S.H.) Baker mealybug use of green lacewing in control studied. Calif. Agric. 3 (3): 7.
5. 1950. (R. L. Doutt & K.S.H.) Biological control measures applied against *Pseudococcus maritimus* on pears. J. Econ. Ent. 43: 94–96.
6. 1950. Fecundity of *Chrysopa californica* affected by synthetic foods. J. Econ. Ent. 43: 101–104.
7. 1950. (with R. L. Doutt) *Brontispa yoshinoi* Barber, a description of adult and immature stages. Ann. ent. Soc. Am. 43: 311–319.
8. 1950. (with G. L. Finney) A food supplement for effectively increasing the fecundity of certain tephritid species. J. Econ. Ent. 43: 735.
9. 1952. Influence of adult nutrition upon fecundity, fertility, and longevity of three tephritid species. Ph.D. Thesis, University of California, Berkeley, California.
10. 1953. A premating period in certain species of the genus *Opius*. Proc. Hawaii ent. Soc. 15: 115–116.
11. 1953. (S. Maeda, K.S.H. & G. L. Finney) Artificial media and the control of microorganisms in the culture of tephritid larvae. Proc. Hawaii ent. Soc. 15: 177–185.
12. 1953. Influence of adult nutrition upon the reproduction of three fruit fly species. pp. 72–76. *In* California Senate, 3rd special report Joint Legislative Committee on Agricultural Livestock Problems on Control of the Oriental Fruit Fly.
13. *1953. (S. Maeda, K.S.H. & G. L. Finney) Role of microorganisms in the culture of fruit fly larvae. pp. 84–86. Ibid.
14. 1954. (R. van den Bosch, E. J. Dietrick & K.S.H.) Foes of California crop pests imported. Western Grower and Shipper 25(8): 40–41.
15. 1956. Aquatic Hymenoptera. pp. 289–292. *In* Usinger, R. L. (ed.). Aquatic insects of California. University of California Press, Berkeley, California.
16. 1956. (R. F. Smith & K.S.H.) Enemies of the spotted alfalfa aphid. Calif. Agric. 10(4): 8–10.
17. 1957. (C. S. Davis, A. S. Deal, J. E. Dibble, R. C. Dickson, E. J. Dietrick, G. L. Finney, H. Graham, K.S.H., I. M. Hall, Jr., J. K. Hollaway, L. G. Jones, J. D. Paschke, B. Puttler, H. T. Reynolds, E. I. Schlinger, R. F. Smith, E. H. Stanford, V. M. Stern, E. S. Sylvester & R. van den Bosch) The spotted alfalfa aphid and its control in California. University of California Agricultural Extension Service Manuscript.
18. *1957. Notes on the convergent lady beetle, *Hippodamia convergens*. Pest Control Review. Jan. 1957: 4–5.
19. 1958. (with J. K. Holloway, F. E. Skinner & G. L. Finney) Aphid parasites established. Calif. Agric. 12(2): 3, 15.
20. *1958. (with R. F. Smith) How many lady beetles are necessary to control aphids in alfalfa? Pest Control Review. March 1958: 3–4.

21. *1958. (with E. E. Stevenson & R. F. Smith) Summary of spotted alfalfa aphid control. Pest Control Review. June 1958: 3–4.
22. 1958. (with R. F. Smith) Chemical and biological methods of pest control. Agric. chem. 13: 30–32, 98–92.
23. 1958. Honeydew as an adult fruit fly diet affecting reproduction. Proc. 10th Int. Cong. Entomol. 3: 25–30.
24. 1959. (R. van den Bosch, E. I. Schlinger, E. J. Dietrick, K.S.H. & J. K. Holloway) The colonization and establishment of imported parasites of the spotted alfalfa aphid in California. J. econ. Ent. 52: 136–141.
25. 1959. (V. M. Stern, R. F. Smith, R. van den Bosch & K.S.H.) The integration of chemical and biological control of the spotted alfalfa aphid. I. The integrated control concept. Hilgardia 29: 81–101.
26. 1959. (R. F. Smith & K.S.H.) The integration of chemical and biological control of the spotted alfalfa aphid. II. Impact of commercial insecticide treatments. Hilgardia 29: 131–154.
27. 1959. (R. F. Smith & K.S.H.) Integrated control programs in the future of biological control. J. econ. Ent. 52: 1106–1108.
28. 1960. Biological control with lady beetles. pp. 28–35. *In* Handbook on biological control of plant pests. Plants & Gardens 16(3) (Special printing).
29. 1960. (with E. I. Schlinger) Imported Indian parasite of pea aphid established in California. Calif. Agric. 14(9): 5–6.
30. 1960. (V. M. Stern, R. F. Smith, R. van den Bosch & K.S.H.) Effectiveness of integrated control programs against pests on agricultural crops. Calif. Agric. 14(9): 7–8.
31. 1960. (E. I. Schlinger, K.S.H. & R. van den Bosch) Imported French parasite of walnut aphid established in California. Calif. Agric. 14(11): 3–4.
32. 1962. Biology and ecology of predaceous Coccinellidae. Ann. Rev. Ent. 7: 289–326.
33. 1962. (R. van den Bosch, E. I. Schlinger & K.S.H.) Initial field observations in California on *Trioxys pallidus* (Haliday) a recently introduced parasite of the walnut aphid. J. econ. Ent. 55: 857–862.
34. 1963. (with L. Santas & A. Tsecouras) A technique of culturing the olive fly, *Dacus oleae* Gmel., on synthetic media under xenic conditions. pp. 333–356. *In* Radiation and radioisotopes allied to insects of agricultural importance. International Atomic Energy Agency, Vienna.
35. 1964. (O. G. Bacon, V. E. Burton, A. S. Deal, K.S.H., C. S. Koehler, H. T. Reynolds, R. F. Smith, V. M. Stern, J. E. Swift & R. van den Bosch) Pest and disease control program for alfalfa hay. Calif. Agric. Exp. Sta. Leaflet #85.
36. 1964. Developmental stages of parasites. pp. 168–246. *In* DeBach, P. (ed.). Biological control of insect pests and weeds. Reinhold, New York.
37. 1964. Nutrition of entomophagous insects and their hosts. pp. 356–380. Ibid.
38. 1964. (P. DeBach & K.S.H.) Manipulation of entomophagous species. pp. 429–458. Ibid.
39. 1965. (R. F. Smith & K.S.H.) Modification of the natural regulation of aphids by local climates in California. pp. 372–374. *In* Freeman, P. (ed.). Proc. XIIth Int. Cong. Entomol., London.

40. 1966. (with R. L. Tassan) A method of providing artifical diets for *Chrysopa* larvae. J. econ. Ent. 58: 999–1000.
41. 1966. (R. van den Bosch & K.S.H.) Predacious and parasitic arthropods in California cotton fields. Calif. Agric. Exp. Sta. Bull. 820.
42. 1966. Dependence of the olive fly, *Dacus oleae,* larvae on symbiosis with *Pseudomonas savastanoi* for the utilization of olive. Nature 209: 423–424.
43. 1966. (D. W. Walker, A. Alemañy, V. Quintana, F. Padovani & K.S.H.) Improved xenic diets for rearing the sugarcane borer in Puerto Rico. J. econ. Ent. 59: 1–4.
44. 1966. (with R. L. Tassan) The influence of protein hydrolysates of yeasts and chemically defined [diets] upon the fecundity of *Chrysopa carnea* Stephens. Vest. Csl. zool. Spol. 30: 219–227.
45. 1966. (with R. R. Sluss) Quantity of aphids required for reproduction by *Hippodamia* sp. in the laboratory. pp. 47–59. *In* Hodek, I. (ed.). Ecology of aphidophagous insects Czechoslovakia Academy of Sciences, Prague.
46. 1966. (with R. L. Tassan) Artificial diet for *Chrysopa carnea* Stephens. pp. 83–87. Ibid.
47. 1966. (with R. L. Tassan) A method of coating droplets of artifical diets with paraffin for feeding *Chrysopa* larvae. pp. 89–90. Ibid.
48. 1966. Coccinellid aggregations. pp. 131–133. Ibid.
49. 1966. Suspected migratory flight behaviour of *Hippodamia convergens*. pp. 135–136. Ibid.
50. 1966. (with R. R. Sluss) Factors influencing the dynamics of walnut aphid populations in northern California. pp. 243–248. Ibid.
51. 1966. (R. F. Smith & K.S.H.) Natural regulation of alfalfa aphids in California. pp. 297–315. Ibid.
52. *1967. (with R. van den Bosch et al.) Biological control of the bollworm. pp. 9–15. *In* University of California, Division of Agriculture Sciences Progress Report on Research 1966.
53. 1967. (J. T. Shimizu & K.S.H.) An artifical oviposition site for some Heteroptera that insert their eggs into plant tissue. Ann. ent. Soc. Am. 60: 1115–1116.
54. 1968. (with R. van den Bosch) Impact of pathogens, parasites and predators on aphids. Ann. Rev. Ent. 13: 325–384.
55. 1968. (with L. E. Caltagirone) A new nearctic species of *Karpinskiella* (Hymenoptera: Pteromalidae). Pan-Pacif. Ent. 44: 241–248.
56. 1970. (with R. L. Tassan) the influence of food wheast and related *Saccaromyces fragilis* yeast products on the fecundity of *Chrysopa carnea* (Neuroptera: Chrysopidae) Can. Ent. 102: 806–811.
57. 1970. (D. R. Laing & K.S.H.) A xenic, partially synthetic diet for the oriental fruit moth, *Grapholitha molesta* (Lepidoptera: Oleuthreutidae). Can. Ent. 102: 25–252.
58. 1970. (R. L. Tassan & K.S.H.) Culturing green lacewings in the home and school. University of California Extension Service, One Sheet Answers 246.
59. 1970. Notes on the convergent lady beetle (*Hippodamia convergens*). University of California Extension Service, One Sheet Answers 247.
60. 1970. Collecting and handling the convergent lady beetle (*Hippodamia con-*

vergens). University of California Extension Service, One Sheet Answers 248.
61. 1970. Following the ladybug home. National Geographic Magazine 137: 542–553.
62. 1970. (with R. L. Tassan & E. F. Sawall, Jr.) Some ecophysiological relationships between certain *Chrysopa,* honeydews and yeasts. Boll. Lab. Ent. Agr. Filippo Silvestri 28: 113–134.
63. 1971. (with R. van den Bosch & D. L. Dahlsten) The importance of naturally-occurring biological control in the western United States. pp. 253–293. *In* Huffaker, C. B. (ed.). Biological Control. Plenum Press, New York.
64. 1971. (R. van den Bosch, T. F. Leigh, L. A. Falcon, V. M. Stern, D. Gonzales & K.S.H.) The developing program of integrated control of cotton pests in California. pp. 377–394. Ibid.
65. 1971. (with E. F. Sawall & R. L. Tassan) The use of food sprays to increase effectiveness of entomophagous insects. Proc. Tall Timb. Conf. Ecol. Anim. Cont. Habit. Manage. 2: 59–81.
66. 1972. (I. Hodek, K.S.H. & H. F. van Emden) Methods for studying effectiveness of natural enemies. pp. 147–188. *In* van Emden, H. F. (ed.). Aphid technology. Academic Press, London.
67. 1972. (with R. L. Tassan) Exploring nutritional roles of extracellular symbiotes on the reproduction of honeydew feeding adult chrysopids and tephritids. pp. 323–351. *In* Rodriguez, J. R. (ed.). Insect and mite nutrition. North-Holland, Amsterdam.
68. 1973. (with J. M. Franz) A history of biological control. pp. 433–476. *In* Smith, R. F., T. E. Mittler & C. N. Smith (eds.). History of Entomology. Annual Reviews Inc., Palo Alto, California.
69. 1974. The significance of predacious Coccinellidae in biological and integrated control of insects. Entomophaga, Mém. Hors-Série. 7: 25–44.
70. 1974. (G. F. Rajendra & K.S.H.) *Trichogramma* oviposition into artifical substrates. Environ. ent. 3: 399–401.
71. 1974. (with R. Hale) Increasing natural enemies through use of supplementary feeding and non-target prey. pp. 170–181. *In* Maxwell, F. E. & F. A. Harris (eds.). Proceedings of the Summer Institute on Biological Control of Plant Insects and Diseases. University Press of Mississippi.
72. 1974. (Book review) Biology of Coccinellidae by I. Hodek. Science 183: 299.
73. 1975. (P. Neuenschwander, K.S.H. & R. F. Smith) Predation on aphids in California's alfalfa fields. Hilgardia 43: 53–78.
74. 1976. Role of nutrition in insect pest management. Proc. Tall Timb. Conf. Ecol. Anim. Cont. Habit. Manag. 6: 221–261.
75. 1976. (with P. Greany, E. F. Sawall, Jr. & R. L. Tassan) Tryptophan in artificial honeydew as a source of an attractant for adult *Chrysopa carnea.* Environ. ent. 5: 458–468.
76. 1976. (H. F. van Emden & K.S.H.) Olfactory reactions of the green lacewing, *Chrysopa carnea,* to tryptophan and certain breakdown products. Environ. ent. 5: 469–473.
77. 1976. (W. R. Bowen, V. E. Burton, K.S.H., V. M. Stern, C. G. Summers &

N. C. Toscano) Insect control guide for alfalfa hay. University of California, Department of Agricultural Sciences Leaflet #2763.
78. 1976. (with S. Bombosch & J. A. McMurtry). The biology and impact of predators. pp. 93–142. *In* Huffaker, C. B. & P. S. Messenger (eds.). Theory and practice of biological control. Academic Press, New York.
79. 1976. (with G. A. Viktorov, K. Yasumatsu, & M. F. Schuster) Biological control of pests of range, forage and grain crops. pp. 397–442. Ibid.
80. 1977. (D. A. Nordlund, W. J. Lewis, R. L. Jones, H. R. Gross, Jr. & K.S.H.) Kairomones and their use for management of entomophagous insects. VI. An examination of the kairomones for the predator *Chrysopa carnea* Stephens at oviposition sites of *Heliothis zea* (Boddie). J. Chem. Ecol. 3: 507–511.
81. *1977. (W. C. Mitchell, C. O. Andrew, K.S.H., R. A. Hamilton, E. J. Harris, K. L. Maehler, & R. H. Rode. The Mediterrean fruit fly and its economic impact on Central American countries and Panama. UC/AID Report on Pest Management and Related Environmental Protection Project.
82. *1977. Biological and integrated control of insect pests in Brazil. Graduate Training, Accomplishments and Future. Brazil/Michigan State PEAS Report.
83. 1977. (D. S. Chandler & K.S.H.) New synonymy of North American *Notoxus* (Coleoptera: Anthicidae). Pan-Pacif. Ent. 53: 230–232.
84. 1977. (T. Finlayson, T. & K.S.H.) Final-instar larvae of parasitic Hymenoptera. Pest Management Paper #10, Simon Fraser University, Burnaby, British Columbia.
85. 1978. (D. E. Pinnock, K.S.H., D. V. Cassidy, R. J. Brand, J. E. Milstead & R. L. Tassan) Integrated pest management in highway landscapes. Calif. Agric. 32(2): 33–34.
86. 1978. Aquatic Hymenoptera. pp. 233–243. *In* Merritt, R. W. & K. W. Cummins (eds.). An introduction to the aquatic insects of North America. Kendall/Hunt, Dubuque, Iowa.
87. 1978. (S. A. Hassan & K.S.H.) A new artificial diet for rearing *Chrysopa carnea* larvae. Z. agnew. Ent. 86: 315–330.
88. 1978. (K.S.H., E. F. Sawall, Jr. & R. L. Tassan) (Abstract) The attraction of *Chrysopa carnea* adults to comercially available predator food sprays. Abstracts of submitted papers Pacific Branch ent. Soc. Am. 62nd Annual Meeting, Scottsdale, Arizona, June 19–22. 1978: 26.
89. 1979. (R. L. Tassan, K.S.H. & E. F. Sawall, Jr.) The influence of field food sprays on the egg production rate of *Chrysopa carnea*. Environ. ent. 8: 81–85.
90. 1979. (W. J. Lewis, M. Beevers, D. A. Nordlund, H. R. Gross, Jr. & K.S.H.) IX. Investigations of various kairomone-treatment patterns for *Trichogramma* spp. J. Chem. Ecol. 5: 673–680.
91. 1979. (with J. A. McMurtry) Natural enemies and predator-prey ratios. pp. 28–40. *In* Davis, D. W., S. C. Hoyt, J. A. McMurtey, & M. T. AliNiazee (eds.) Biological control and insect pest management. University of California, Division of Agricultural Sciences, Priced Publication #4096.
92. 1979. (with G. W. Bishop) Use of supplemental food and behavioral chemicals to increase the effectiveness of natural enemies. pp. 49–60. Ibid.

93. 1979. (M. T. AliNiazee, K.S.H., & S. C. Hoyt) Current trends and future outlook. pp. 96–102. Ibid.
94. 1979. (G. J. Tsiropoulos & K.S.H.) Ovipositional response of the walnut husk fly, *Rhagoletis completa,* to artificial substrates. Z. agnew. Ent. 88: 547–550.
95. 1980. (P. Neuenschwander & K.S.H.) Role of the predator *Hemerobius pacificus* in a non-insecticide treated artichoke field. Environ. ent. 9: 492–495.
96. 1980. (W. J. Lewis, K.S.H., W. L. Roelofs & L. M. Schoonhoven) Status and potential use of behavioral chemicals in pest management. FAO Plant Protection Bulletin 28: 121–128.
97. 1981. (A. P. Gutierrez, J. U. Baumgaertner & K.S.H.) A conceptual model for growth, development, and reproduction in the ladybird beetle, *Hippodamia convergens* (Coleoptera: Coccinellidae). Can. Ent. 113: 21–33.
98. 1981. (P. Greany & K.S.H.) Prey selection. pp. 121–135. *In* Nordlund, D. A., R. L. Jones & W. J. Lewis (eds.). Semiochemicals—their role in pest control. Wiley, New York.
99. 1981. (J. B. Johnson & K.S.H.) A neuropterous larva uses an allomone to attack termites. Nature 289: 506–507.
100. 1981. (with W. W. Allen & R. L. Tassan) Mediterranean fruit fly: the worst may be yet to come. Calif. Agric. 35(3 & 4): 5–7.
101. 1981. IOBC Presidential address. Int. Org. Biological Control Newsletter #19-20: 1–4.
102. 1981. (R. L. Tassan, K.S.H. & D. V. Cassidy) (Abstract) Biological control of ice plant scales in California. Abstracts of submitted and invited papers, Pacific Branch ent. Soc. Am. 65th Annual Meeting, Oakland, California, June 22–25, 1981: 8.
103. *1982. (with R. L. Tassan) Ecology and biological control of ice plant scales, *Pulvinariella mesembryanthemi* and *Pulvinaria delottoi* in California. Interim report, July 1978 to June 30, 1981, State of California Department of Transportation, Division of Highway Maintenance.
104. 1982. (R. L. Tassan, K.S.H., & D. W. Cassidy) Imported natural enemies established against ice plant scales in California. Calif. Agric. 36(9 & 10): 16–17.
105. *1982. (J. R. Coulson, W. Klassen, R. J. Cook, E. G. King, H. C. Chiang, K.S.H. & W. G. Yendol) Biological control of pests in China. USDA Office ICD, Scientific Technology Exchange Division, China Program. Washington, D.C.
106. 1982. (M. A. Altieri, K.S.H., J. Trujillo & L. E. Caltagirone) Biological control of *Limax maximus* and *Helix aspera* by indigenous predators in a daisy field in central coastal California. Oecol. Appl. 3: 387–390.
107. 1983. (J. A. Washburn, R. L. Tassan, K. Grace, E. Bellis, K.S.H. & G. W. Frankie) Effects of malathion sprays on the ice plant insect system. Calif. Agric. 37(1 & 2): 30–32.
108. 1983. (R. Charudattan & K.S.H.) Practice and implementation of biological control overview. pp. 49–50. *In* Battenfield, S. L. (ed.). Proceedings of the National Interdisciplinary Biological Control Conference, Las Vegas, Nevada. CRS/USDA Publication.

109. 1983. (H. C. Hoch & K.S.H.) Increasing abundance and effectiveness of natural enemies. pp. 55–59. Ibid.
110. 1983. (R. L. Tassan, K.S.H., A. Cheng, T. K. Palmer, G. Feliciano & T. L. Blough) Mediterranean fruit fly life cycle estimations for the California eradication program. pp. 564–570. *In* Cavalloro, R. (ed.). Fruit flies of economic importance. A. A. Balkema, Rotterdam.
111. 1984. (Abstract) Ecosystem analysis: plant cultivars (HPR), entomophagous species and food supplements. Abstr. XVIIth Int. Cong. Ent.: 335
112. 1984. (with R. H. Dadd & J. Reese) The food of insects. pp. 79–112. *In* Huffaker, C. B. & R. L. Rabb (eds.). Ecological Entomology. Wiley, New York.
113. 1984. Aquatic Hymenoptera. pp. 438–447. *In* Merritt, R. W. & K. W. Cummins (eds.). An introduction to the aquatic insects of North America. (2nd ed.) Kendall/Hunt, Dubuque, Iowa.
114. 1985. (Z. Ruzicka & K.S.H.) Impact of parasitism on migratory flight performance in females of *Hippodamia convergens* (Coleoptera). Acta ent. bohemoslovaca 82: 401–406.
115. 1985. (R. Garcia & K.S.H.) The occurrence of adult dytiscids in dry waterfowl refuge ponds in California. Coleopts. Bull. 39: 391–392.
116. 1986. Dietary requirements for mass rearing of natural enemies for use in biological control. pp. 35–86. *In* Hussein, M. Y. & A. G. Ibrahim (eds.). Biological control in the tropics. Proceedings of the first regional symposium on biological control held at Universiti Pertanian Malaysia, Serdang from 4–6 September, 1985.
117. 1986. (Z. Ruzicka & K.S.H.) Influence of *Perilitus coccinellae* on the flight performance of overwintered *Hippodamia convergens.* pp. 229–232. *In* Hodek, I. (ed.). Ecology of Aphidophaga. Academy of Prague & Dr. W. Junk, Dordrecht.
118. *1986. (G. W. Frankie & K.S.H.) Ecology and biology of ice plant scales, *Pulvinaria* and *Pulvinariella* in California. Final report, State of California Department of Transportation, Division of Highway Maintenance.
119. 1986. Ecosystem analysis: plant cultivars (HPR) entomophagous species and food supplements. pp. 151–197. *In* Boethel, D. J. & R. D. Eikenbary (eds.). Interactions of plant resistance and parasitoids and predators of insects. Ellis Horwood Ltd., Chichester.
120. *1986. Habitats of Sacramento and Antioch anthicid beetles (Coleoptera: Anthicidae). Report to State of California Department of Parks and Recreation.
121. 1986. (S. H. Dreistadt, K.S.H. & D. L. Dahlsten) Predation by *Iridomyrmix humilis* [Hym.: Formicidae] on eggs of *Chrysoperla carnea* [Neu.: Chrysopidae] released for inundative control of *Illinoia liriodendri* [Hom.: Aphididae] infesting *Liriodendron tulipifera.* Entomophaga 31: 397–400.
122. 1987. Nutritional ecology of terrestrial insect predators. pp. 533–577. *In* Slansky, F. Jr. & J. G. Rodriguez (eds.). The nutritional ecology of insects, mites, and spiders. John Wiley and Sons, New York.
123. 1987. (R. Garcia & K.S.H.) Summer dormancy in adult *Agabus disintegratus* (Crotch) (Coleoptera: Dytiscidae) in dried ponds in California. Ann. ent. Soc. Am. 80: 267–271.

124. 1987. (G. J. Tsiropoulos & K.S.H.) Effect of nutritional deficiencies, produced by antimetabolites, on the reproduction of *Rhagoletis completa* Cresson (Dipt., Tephritidae). Z. agnew. Ent. 103: 351–354.
125. 1987. (S. H. Dreistadt, D. L. Dahlsten & K.S.H.) Integrated pest management of tuliptree aphids. pp. 35–37. *In* Minimal Maintenance Landscaping. A report to the Elvenia J. Slosson Fund for Ornamental Horticulture: 1983–1986. University of California, Division of Agriculture and Natural Resources.
126. 1987. (P. Neyman & K.S.H.) (Abstract). *Toxoptera aurantii* on camellias in a large urban garden: abundance and control by natural enemies. Abstracts of submitted and invited papers. Pacific Branch ent. Soc. Am. 71st Annual Meeting, Portland, Oregon, June 23–25 1987: 13.
127. 1987. (T. Wipperfurth, K.S.H. & T. E. Mittler) Egg production by the coccinellid *Hippodamia convergens* fed on two morphs of the green peach aphid, *Myzus persicae.* Entomologia exp. appl. 44: 195–198.
128. 1988. (Abstract) (R. Garcia & K.S.H.). Ecological adaptations for survival in *Agabus disintegratus* (Crotch) (Coleoptera: Dytiscidae). Proc. XVIIIth Int. Cong. Ent., Vancouver, B.C., Canada: 34.
129. 1988. (Abstract). Physiological interactions in host-parasite systems and their implications for biological control. Proc. XVIIIth Int. Cong. Ent., Vancouver, B.C., Canada: 98.
130. 1990. (A. P. Gutierrez, K.S.H. & C. K. Ellis) Evaluating the impact of natural enemies: a multitrophic perspective. pp. 81–109. *In* Mackauer, M., L. E. Ehler & J. Roland (eds.). Critical issues in biological control. Intercept Ltd. Andover, Hants, U.K.
131. 1990. (R. Garcia, K.S.H., W. G. Voight) Life history, termination of summer diapause, and other seasonal adaptations of *Agabus disintegratus* (Crotch) (Coleoptera: Dytiscidae) in the Central Valley of California. Quaest. ent. 26: 139–149.
132. 1990. Biological control of insect pests in alfalfa hay. pp. 74–83. *In* Proceedings of the 20th California Alfalfa Symposium, Visalia, California. University of California Cooperative Extension Service, Davis, California.
133. 1990. (with S. H. Dreistadt) First California record for *Anthocoris nemoralis* (Fabr.) (Hemiptera: Anthocoridae), a predator important in the biological control of psyllids (Homoptera: Psyllidae). Pan-Pacif. Ent. 66: 323–324.
134. 1991. (M. Y. Hussein & K.S.H.) Rearing of *Hippodamia convergens* on artifical diet of chicken liver, yeast and sucrose. Ent. exp. appl. 59: 197–199.
135. 1991. (C. G. Summers, K.S.H. & V. M. Stern) U. C. IPM pest management guidelines: Alfalfa. University of California Department of Agriculture and Natural Resources Publication #3339.
136. 1992. (P. G. da Silva, K.S.H. & A. P. Gutierrez) Functional response of *Curinus coeruleus* (Col.: Coccinellidae) to *Heteropsylla cubana* (Hom.: Psyllidae) on artificial and natural substrates. Entomophaga 37: 555–564.
137. 1992. (K. M. Daane, G. Y. Yokota, R. F. Gill, L. E. Caltagirone, K.S.H., D. Gonzalez, P. Stary, & W. E. Chaney) Imported parasite may help control European asparagus aphid. Calif. Agric. 46 (6): 12–14.
138. *1992. (L. F. Schultz & K.S.H.) Report of the evaluation mission on the

collaborative project on the biological control of tsetse and crop pests by the International Center of Insect Physiology and Ecology and the Department of Entomology, Vageningen Agricultural University.

139. 1993. (Y. Zheng, K. M. Daane, K.S.H. & T. E. Mittler) Influence of larval dietary supply on food consumption, food utilization efficiency, growth and development of the lacewing *Chrysoperla carnea.* Ent. exp. appl. 67: 1–7.
140. 1993. (Y. Zheng, K.S.H., K. M. Daane & T. E. Mittler) Influence of larval food consumption on the fecundity of the lacewing *Chrysoperla carnea.* Ent. exp. appl. 67: 9–14.
141. *1993. (with L. E. Caltagirone) Biological control of the pepper tree psyllid. Final report to State of California Department of Transportation, RT56G062.
142. 1993. (K. M. Daane, G. Y. Yokota, Y. D. Rasmussen, Y. Zheng & K.S.H.) Effectiveness of leafhopper control varies with lacewing release methods. Calif. Agric. 47 (6): 19–23.
143. *1994. (Abstract) *Stethorus histrio,* a predator of tetranychid mites from Australia established in California. 78th Annual Meeting Pacific Branch Ent. soc. Am.
144. 1994. (S. H. Dreistadt & K.S.H.) European elm scale (Homoptera: Eriococcidae) abundance and parasitism in northern California. Pan-Pacif. Ent. 70: 240–252.
145. 1994. (S. H. Dreistadt & K.S.H.) Classical biological control of the acacia psyllid, *Acizzia uncatoides* (Homoptera: Psyllidae), and predator-prey-plant interactions in the San Francisco Bay area. Biol. Cont. 4: 319–327.
146. 1995. (K. M. Daane, G. Y. Yokota, K.S.H. & Y. Zheng) Field evaluation of *Chrysoperla* spp. in augmentative release programs for the variegated grape leafhopper, *Erythroneura variabilis.* pp. 105–120. *In* Nicoli, G., M. Benuzzi, & N. C. Leppla (eds.). Proceedings of the 7th Workshop of the IOBC working group: Quality control of mass reared arthropods. Rimini, Italy.
147. 1995. (J. A. McMurtry, L. A. Andres, T. S. Bellows, Jr., S. C. Hoyt & K.S.H.) A historical overview of regional research project W-84. pp. 3–5. *In* Nechols, J. R., L. A. Andres, J. W. Beardsley, R. D. Goeden, & C. G. Jackson (eds.). Biological control in the western United States. University of California, Division of Agriculture and Natural Resources Publication #3361.
148. 1995. (J. W. Beardsley, K.S.H., J. R. Leeper, & R. L. Tassan) Acacia psyllid. pp. 91–92. Ibid.
149. 1995. (T. R. Unruh, P. H. Westigard, & K.S.H.) Pear psylla. pp. 95–100. Ibid.
150. 1995. (K. M. Daane, K.S.H., D. Gonzalez, & L. E. Caltagirone) European asparagus aphid. pp. 120–122. Ibid.
151. 1995. (D. Gonzalez, K.S.H., P. Stary, G. W. Bishop, D. W. Davis, & K. S. Pike) Pea aphid and blue alfalfa aphid. pp. 129–135. Ibid.
152. 1995. (M. T. AliNiazee & K.S.H.) Walnut aphid. Part 1. pp. 140–141. Ibid.
153. 1995. (C. E. Kennett, K.S.H. & K. M. Daane) Citricola scale. pp. 148–149. Ibid.
154. 1995. (R. L. Tassan & K.S.H.) Iceplant scales. pp. 150–154. Ibid.
155. 1995. (L. K. Etzel, K.S.H., D. Gonzalez & J. J. Ellington) Egyptian alfalfa weevil. pp. 176–179. Ibid.

156. 1995. (with R. L. Tassan., M. Fong & M. T. AliNiazee) Walnut husk fly. pp. 224–227. Ibid.
157. 1995. (S. H. Dreistadt, K.S.H. & L. G. Bezark) *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae), first western United States record for this Asiatic lady beetle. Pan-Pacif. Ent. 71-135–136.
158. 1996. Aquatic Hymenoptera. pp. 474–483. *In* Merritt, R. W. & K. W. Cummins (eds.). An introduction to the aquatic insects of North America. 3rd ed. Kendall/Hunt, Dubuque, Iowa.
159. 1996. (K. M. Daane, G. Y. Yokota, Y. Zheng & K.S.H.) Inundative release of common green lacewings (Neuroptera: Chrysopidae) to suppress *Erythroneura variabilis* and *E. elegantula* (Homoptera: Cicadellidae) in vineyards. Environ. ent. 25: 1224–1234.
160. 1998. (K. M. Daane, K.S.H. & N. J. Mills) Predaceous insects for insect and mite management. pp. 62–115. *In* Ridgway, R. L., M. P. Hoffmann, M. N. Inscoe, and C. S. Glenister (eds.). Mass-reared natural enemies: application, regulation, and needs. Thomas Say Publications in Entomology. Entomological Society of America, Lanham, Maryland.
161. 1999. (with N. J. Mills, G. Gordh, & J. A. McMurtry) Terrestial arthropod predators of insect and data mite pests. pp. 383–503. *In* Bellows, T. S., T. W. Fisher, L. E. Caltagirone, D. L. Dahlsten, C. Huffaker & G. Gordh (eds.). Handbook of biological control. Academic Press. San Diego, California.
162. 1999. (S. N. Thompson & K.S.H.) Nutrition of entomophagous insects and other arthropods. pp. 594–652. Ibid.
163. 2000. (M. J. Tauber, C. A. Tauber, K. M. Daane & K.S.H.) Commercialization of predators: recent lessons from green lacewings (Neuroptera: Chrysopidae: *Chrysoperla*). American Entomologist 46: 26–38.
164. 2000. (K. M. Daane, M. S. Barzman, L. E. Caltagirone & K.S.H.) *Metaphycus anneckei* and *M. hageni* (Hym.: Encyrtidae): two discrete species parasitic on the black scale, *Saissetia oleae.* BioControl 45: 269–284.
165. *2001. (K. M. Daane & K.S.H.) An evaluation of lacewing releases in North America. pp. 398–407. *In* McEwen, P. K., T. R. New, & A. Whittington (eds.). Lacewings in the crop environment. Cambridge University Press, London.

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Literature Cited

Buckingham, G. R. & M. J. Sharkey. 1988. Abdominal exocrine glands in Braconidae (Hymenoptera). pp. 199–242. *In* Gupta, V. K. (ed.). Advances in Parasitic Hymenoptera Research, 1988.

Chandler, D. S. 1982. A revision of North American *Notoxus* with a cladistic analysis of the New World species. Entomography 1: 333–438.

Daane, K. & L. E. Caltagirone. 1999. A new species of *Metaphycus* (Hymenoptera: Encyrtidae) parasitic on black scale, *Saissetia oleae* (Olivier) (Homoptera: Coccidae). Pan-Pacif. Ent. 75: 13–17.

Gordon, R. D. 1985. The Coleoptera (Coccinellidae) of America north of Mexico. J. New York Ent. Soc. 93: 1–912.

Hagen, K. S. 1970. Following the ladybug home. National Geographic Magazine 137: 542–553.

Hagen, K. S. & L. E. Caltagirone. 1968. A new nearctic species of *Karpinskiella* (Hymenoptera: Pteromalidae). Pan-Pacif. Ent. 44: 241–248.

Summers, C. G. 1998. Integrated pest management in forage alfalfa. Integrated Pest Management Reviews 3: 127–154.

Tauber, C. A. 1969. Taxonomy and biology of the lacewing genus *Meleoma* (Neuroptera: Chrysopidae), Univ. Calif. Publ. Ent. 58: 1–94.

Vandenberg, N. J. 1992. Revision of the New World lady beetles of the genus *Olla* and description of a new allied genus (Coleoptera: Coccinellidae). Ann. Ent. Soc. Am. 85: 370–392.

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